

One-axis controlled repulsive type magnetic bearings

Keywords: magnetic bearing, permanent magnet, repulsive type, one-axis type, low rotational loss, polygon mirror, bearingless motor, Halbach array, balance, conveyor

【Mechanical bearings】

- Support of a certain distance between mover and stator of linear/rotating machines
- Friction loss, need for periodic maintenances, and effect of operating environment.

【Magnetic bearings】

- Non-contact suspension enabled by magnetic force
- Frictionless, maintenance-free, and operation under special circumstance
- Expensive, complicated system, and need for power feeding.

【Classification by number of controlled axes】

Number of axes	0 axis	→	5 axes
Control type	passive	→	active
Controllability	bad	→	good
System	simple	→	complex
General versatility	low	→	high
Stator side bearing	small-sized	→	large-sized
Power consumption	low	→	high

【One-axis controlled type】

This is a method of repulsive suspension of 4-axes excluding a rotating axis using permanent magnets. This enables simplification of peripheral equipment, miniaturization, power-saving, and low rotating loss. However, from the standpoint of controllability, this method should be limited to special use.

【Classification by axis layout】

Vertical shaft type:

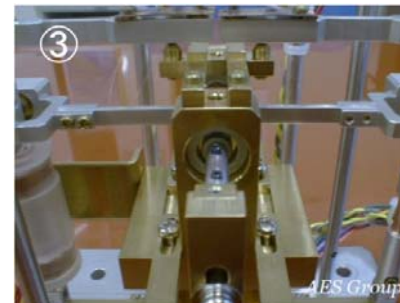
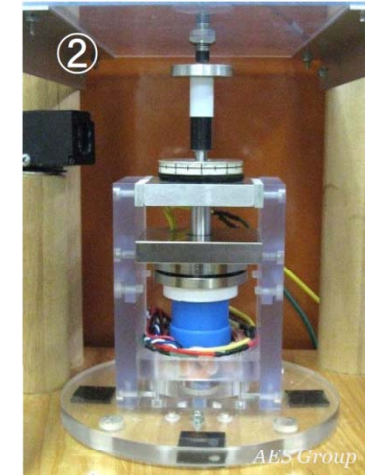
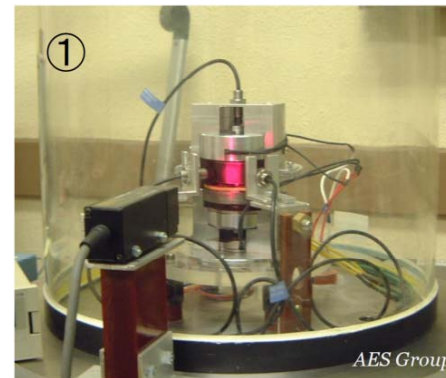
- Use of cylindrical magnets → extreme low rotating loss
- High-speed rotating machine → information device, pump

Horizontal shaft type:

- Subduction will occur resulted from self-weight.
- Low-speed rotating machine → loading detective conveyor
- Non-rotating machine → micro-mass measurement balance

【Integration of magnetic bearings and motors】

In the case of using one-axis controlled type, some distances between elements of each part need to be maintained. Use of one-axis controlled type realizes integration of magnetic bearings and motors which is known as a bearingless motor (BeLM).



Photos: ① polygon mirror ② bearingless motor ③ balance ④ conveyor